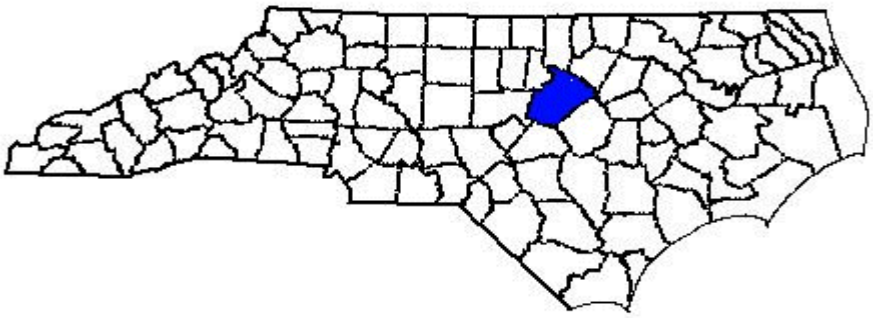
ANNUAL REPORT FOR 2008



Marks Creek Mitigation Site
Wake County
TIP No. R-2547WM

Prepared By:
Natural Environment Unit & Roadside Environmental Unit
North Carolina Department of Transportation
January 2008

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Marks Creek Mitigation Site. This site was originally constructed in 2002. Monitoring activities in 2008 represent the fifth year of monitoring for the site. The site must be monitored for five consecutive years or until the site is deemed successful.

Site hydrology is monitored with thirteen groundwater gauges, three surface water gauges, and one onsite rain gauge. Per a resource agency request, an additional groundwater-monitoring gauge (MCGW-13) was installed in July 2005. There are four vegetation-monitoring plots established throughout the wetland enhancement and restoration areas.

This report utilizes rainfall data from both a local weather station and from an on-site rain gauge. The NC State Climate Office provided historical data for the Raleigh/Durham weather station.

Hydrologic monitoring indicated that three of the seven monitoring gauges located in zone 1 met the hydrology success criteria of 12.5% for the 2008-growing season. One of the six monitoring gauges located in zones 2 and 3 met the hydrology success criteria of 8.0%.

Based on the results of the fifth year of monitoring, the site revealed an average density of 605 trees per acre, which is well above the minimum success criteria of 260 trees per acre.

An on-site agency meeting was held in August 2005 to review the location of the new gauge (MCGW-13) that was installed in July 2005. It was observed that a small portion of Zone 1, located just south between GW-7 and GW-8, is situated on a knoll. This area will be removed from final credits based on agency comment and approval.

An on-site agency meeting was held in April 2006 to review the stability of the stream restoration. Six days prior to the onsite meeting, a severe storm occurred damaging a transformer at a Progress Energy Substation upstream of the mitigation site. Approx. 16,000 gallons of mineral oil was spilled into the UT to Marks Creek. Cleanup activities occurred for several weeks after the spill and at this time the site continues to recover with much of the affected vegetation returning.

The entire 4.4 acres of Zone 1 have been debited for wetland credit. Based on the gauge data, all of Zone 1 does not meet wetland success criteria. Zones 2 and 3 were never debited at the site. There are portions of these zones that do meet wetland success criteria based on gauge data. A re-delineation of the site based on gauge data and field indicators will determine how much wetland credit is available. Preliminary mapping based on gauge data shows there is sufficient credit available to cover the 4.4 acres of debited wetland. A site visit with the regulatory agencies will be scheduled to verify a final delineation of the site.

NCDOT proposes to discontinue hydrology and vegetation monitoring at the Marks Creek Mitigation Site.

1.0 INTRODUCTION

1.1 Project Description

The Marks Creek Mitigation Site is located approximately two miles southeast of Knightdale off of Knightdale-Eagle Rock Road (SR 2501). The site is immediately adjacent to the Knightdale Bypass. The site consists of wetland restoration and enhancement areas. It was constructed in 2002 and planted in 2003. The restoration area is 12.66 acres, however only 4.4 acres of zone 1 have been debited.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetation monitoring must be conducted for a minimum of five consecutive years or until the site is deemed successful. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival.

Activities in 2008 reflect the fifth year of monitoring following the restoration efforts. Included in this report are analyses of hydrologic and vegetation monitoring results, as well as local climate conditions throughout the growing season, and site photographs.

1.3 Project History

March 2002	Enhancement and Upland Areas Planted
April 2003	Restoration Area Planted
March 2004	Supplemental Planting in Restoration Area
March-November 2004	Hydrology Monitoring (1 yr.)
June 2004	Vegetation Monitoring (1 yr.)
March-November 2005	Hydrology Monitoring (2 yr.)
July 2005	Vegetation Monitoring (2 yr.)
March-November 2006	Hydrology Monitoring (3 yr.)
July 2006	Vegetation Monitoring (3 yr.)
March-November 2007	Hydrology Monitoring (4 yr.)
July 2007	Vegetation Monitoring (4 yr.)
March-November 2008	Hydrology Monitoring (5 yr.)
June 2008	Vegetation Monitoring (5 yr.)
March-November 2008	Hydrology Monitoring (5 yr.)

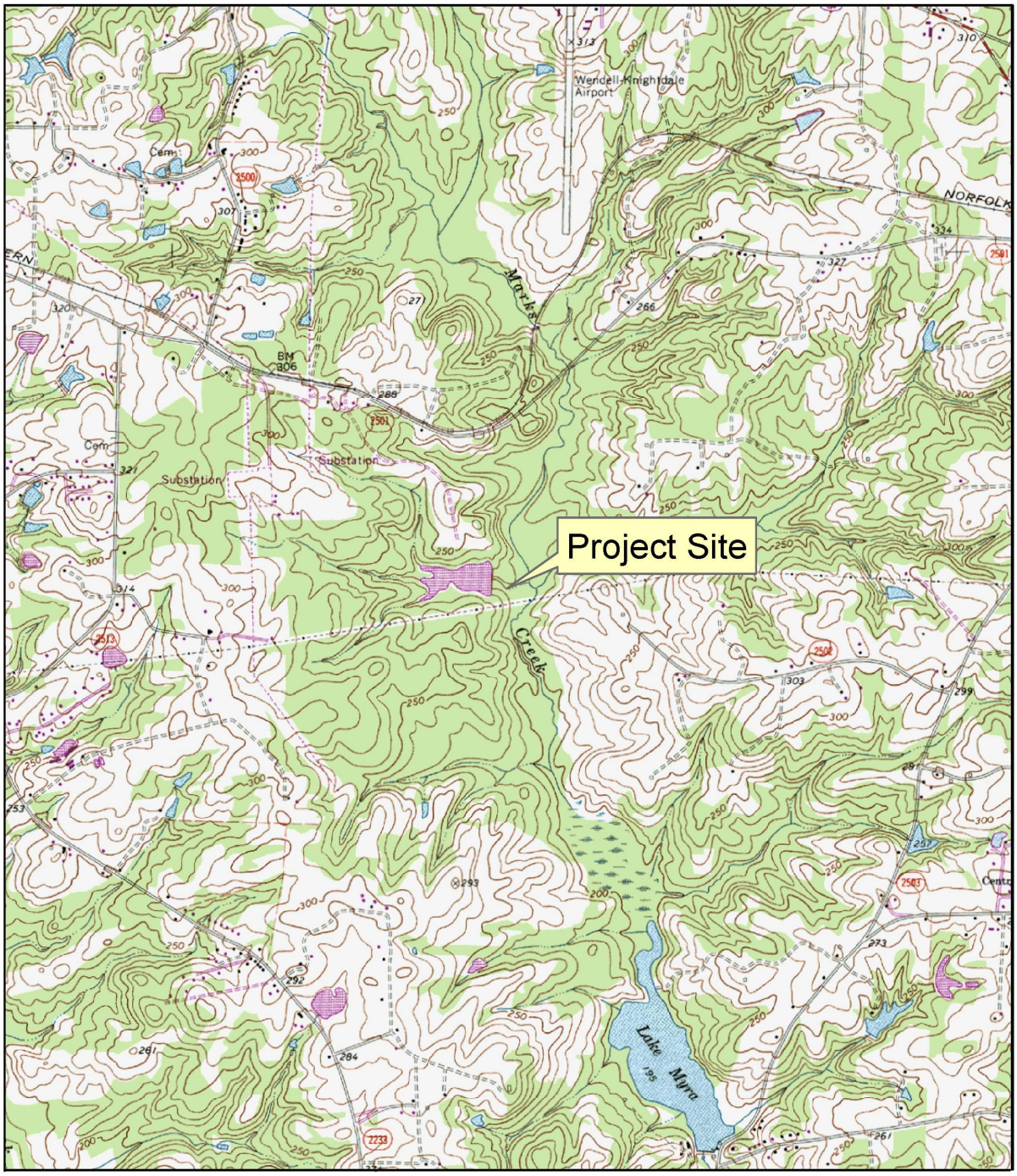


Figure 1. Site Location Map

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with the mitigation plan and permit for wetland mitigation, the success criteria for hydrology state that zone 1 must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season. Zones 2 and 3 must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 8.0% of the growing season. Areas inundated or saturated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated or saturated between 5% and the minimum successful saturation period (8 – 12.5%) can be classified as wetlands depending upon factors such as the presence of wetland vegetation and hydric soils.

The growing season in Wake County begins March 26 and ends November 10. These dates correspond to a 50% probability that temperatures will not drop to 28°F or lower after March 26 and before November 10.[1] The growing season is 229 days; therefore, hydrology for 12.5% of the growing season is at least 29 consecutive days, while 8.0% is at least 18 consecutive days. Local climate must also represent average conditions for the area.

2.2 Hydrologic Description

In June of 2003, twelve groundwater-monitoring gauges and three surface water-monitoring gauges were installed across the site (Figure 2). In July of 2005, one additional groundwater gauge was installed. The groundwater gauges are set to record daily water levels, while the surface water gauges are set to record at 4-hour intervals. A rain gauge is also located on the site in order to get accurate site rainfall measurements. The hydrologic response (groundwater) to rainfall events is evaluated using this data.

The Marks Creek site was designed to receive hydrologic input from rainfall and water accessing the floodplain. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events, as well as the surface water level.

The site consists of wetland restoration and enhancement areas. The restoration area is 12.66 acres, however only 4.4 acres of Zone 1 have been debited.

[1] Natural Resources Conservation Service, Soil Survey of Wake County, North Carolina, p. 79.

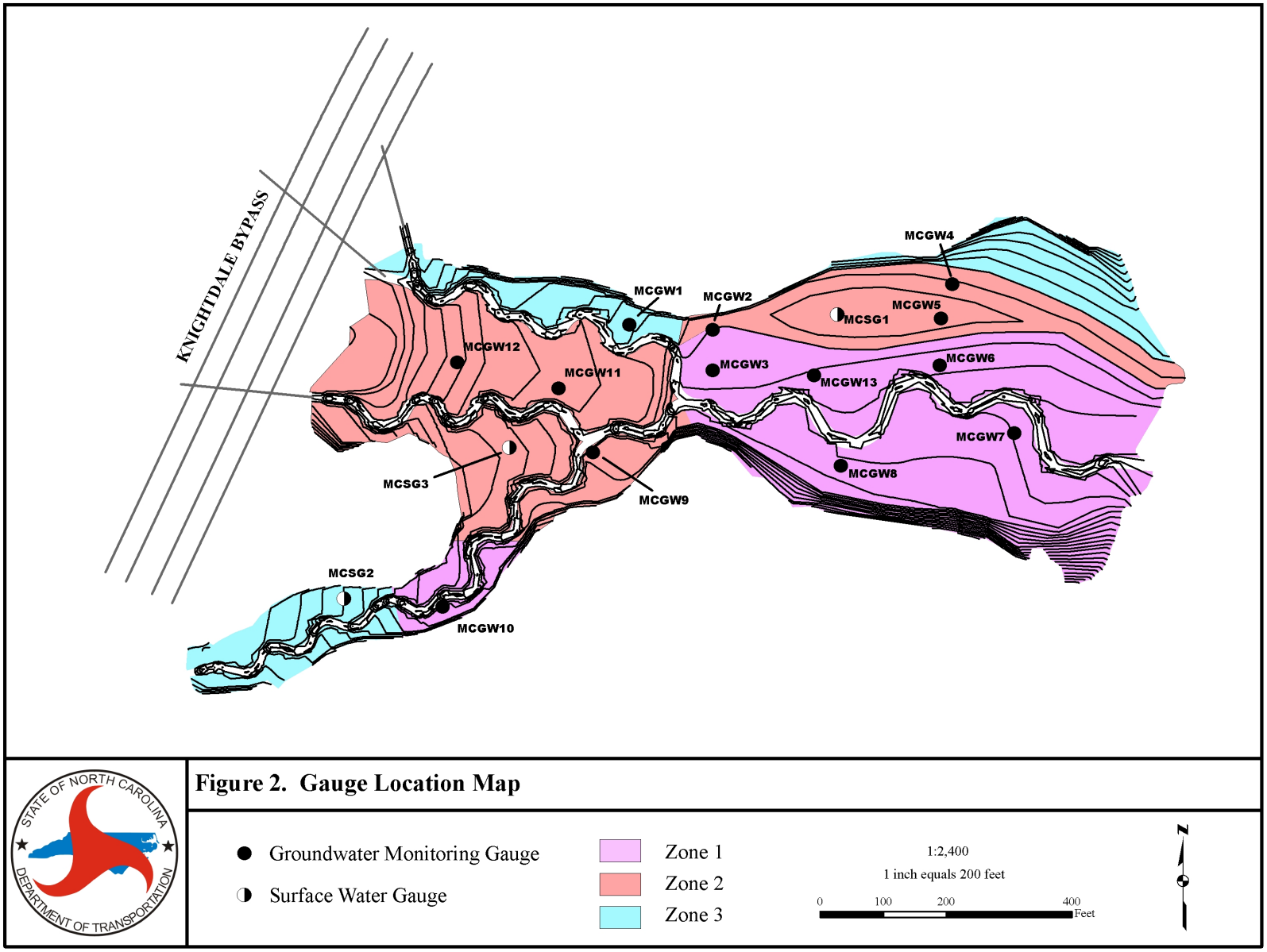


Figure 2. Gauge Location Map

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each well. This number was converted into a percentage of the 229-day growing season (March 26 – November 10). The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring well. If the gauge shows saturation for greater than 12.5% (Zone 1) or 8% (Zones 2 & 3) of the growing season, the maximum number of consecutive days is noted on each graph. The individual precipitation events are shown on the monitoring well graphs as bars.

Figure 3 provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in red show hydrology between 8% and 12.5% of the season, while those in green indicate hydrology between 5% and 8% of the season. Gauges highlighted in black indicate no wetland hydrology (less than 5% of the growing season). Please note that gauges shown in red or blue meet the hydrology criteria in Zones 2 & 3.

Table 1. 2008 Hydrologic Monitoring Results

Monitoring Well	Zone	Expected	<5%	5-8%	8-12.5%	>12.5%	Actual %	Success Dates
MCGW 1	**3**	**>8.0**				×	17.8	Mar 31 - May 10
MCGW 2	**1**	**>12.5**			×		8.3	
MCGW 3	**1**	**>12.5**	×				4.8	
MCGW 4	**2**	**>8.0**	×				3.9	
MCGW 5	**2**	**>8.0**	×				1.7	
MCGW 6	**1**	**>12.5**		×			6.5	
MCGW 7+	**1**	**>12.5**				×	100.0	Mar 26-Nov 10
MCGW 8+	**1**	**>12.5**				×	59.1	Mar 26 - Aug 8 Aug 27 - Nov 10
MCGW 9+	**2**	**>8.0**				×	100.0	Mar 26-Nov 10
MCGW 10+	**1**	**>12.5**				×	100.0	Mar 2-Nov 10
MCGW 11	**2**	**>8.0**	×				3.5	
MCGW 12	**2**	**>8.0**	×				3.9	
MCGW 13	**1**	**>12.5**		×			6.1	

Specific Gauge Problems:

- MCGW- 2 experience gauge malfunction from June to August.

Table 2. Hydrologic Monitoring Results (2004-2008)

Monitoring Gauge	2004 Results	2005 Results	2006 Results	2007 Results	2008 Results
MCGW 1	4.8	13.0	7.8	6.5	17.8
MCGW 2	3.1	11.7	7.8	6.1	8.3
MCGW 3	4.8	5.2	2.6	3.0	4.8
MCGW 4	1.7	1.7	1.7	1.7	3.9
MCGW 5	1.7	0	0.9	0.9	1.7
MCGW 6	21.8	12.6	3.5	5.2	6.5
MCGW 7	64.2	63.9	100.0	100.0	100.0
MCGW 8	98.3	36.1	63.9	61.7	59.1
MCGW 9	77.7	63.9	63.9	100.0	100.0
MCGW 10	95.6	36.1	63.9	100.0	100.0
MCGW 11	3.5	10.0	3.5	1.7	3.5
MCGW 12	1.7	5.2	2.2	1.3	3.9
MCGW 13	n/a	51.7	10.4	12.2	6.1
Climate Conditions	Average/ Above Average Rainfall	Average Rainfall	Average Rainfall	Below Average Rainfall	Below Average Rainfall

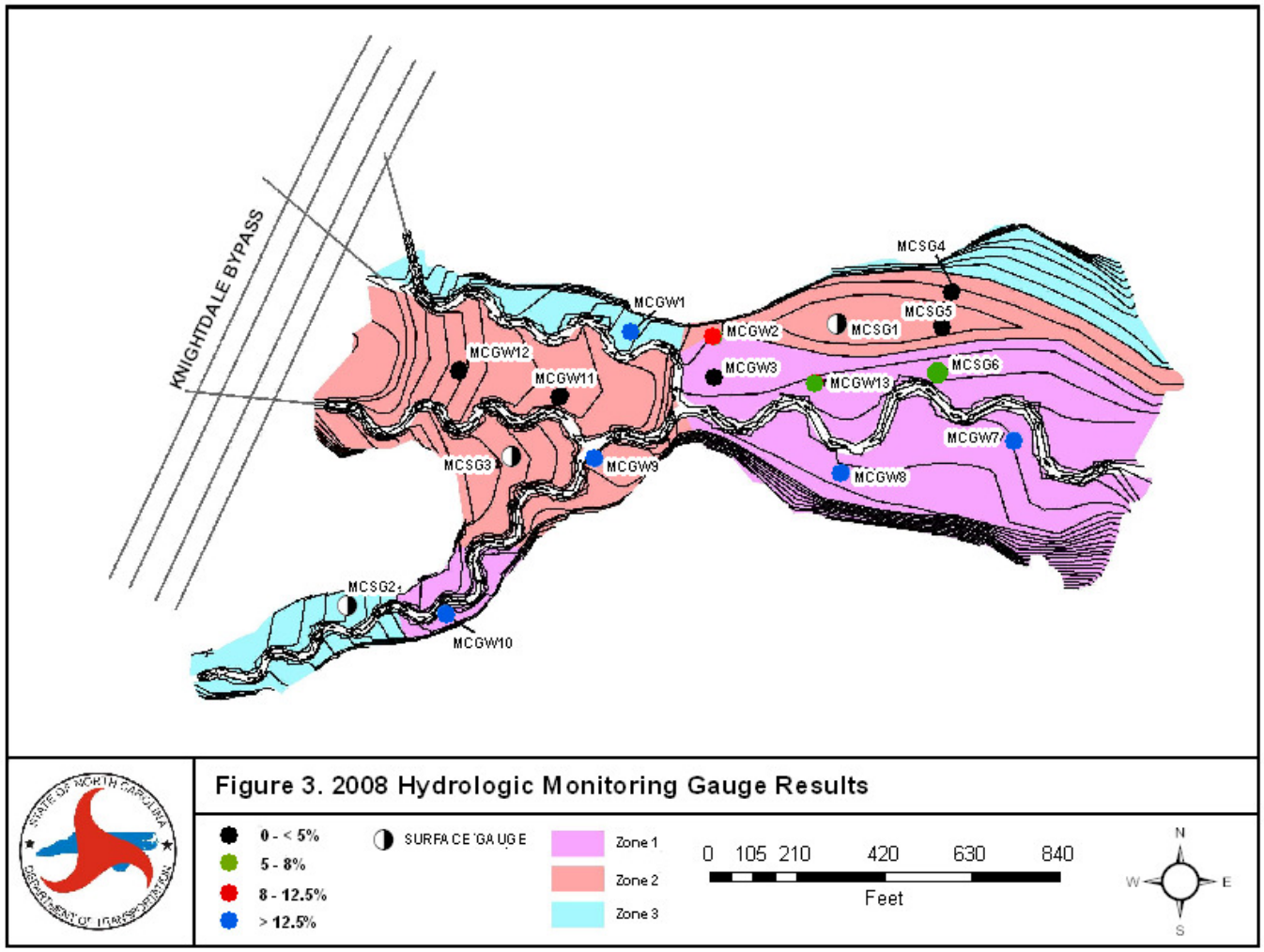


Figure 3. 2008 Hydrologic Monitoring Results

2.3.2 Climatic Data

Figure 4 provides an examination of the local climate in comparison with historical data in order to determine whether 2008 was "average" in terms of climate conditions. The two lines represent the 30th and 70th percentiles of monthly precipitation for Raleigh. The bars are the monthly rainfall totals for November 2007 through November 2008. The NC State Climate Office collected the historical data for the Raleigh weather station.

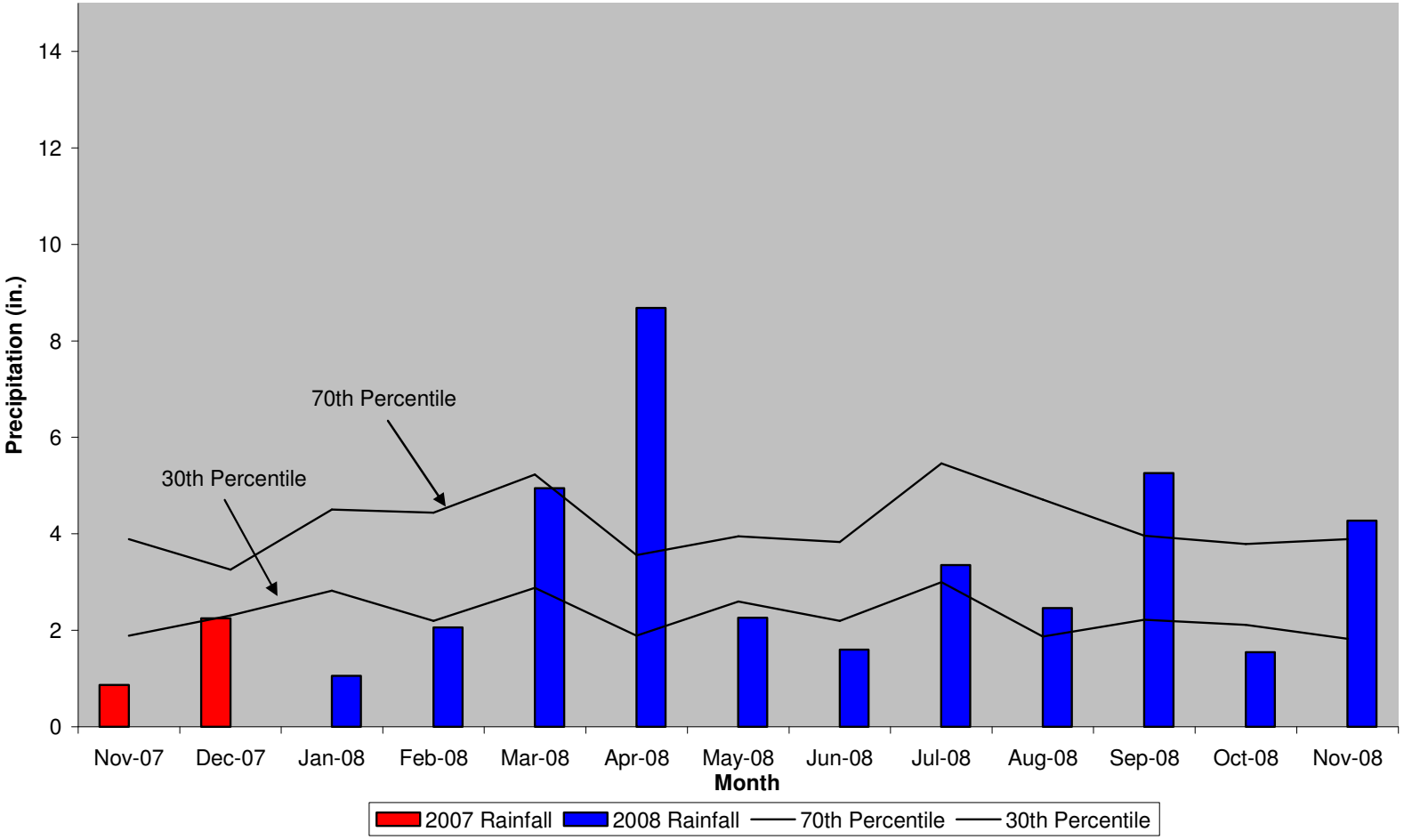
For the 2008-year the below average rainfall months include January, February, May, June, and October. The months of March, July and August recorded average rainfall. The months of April, September and November recorded above average rainfall. Overall, the site experienced below average rainfall in 2008.

2.4 Conclusions

The 2008-year represents the fifth year of hydrology monitoring on the Marks Creek Site. Three of the seven monitoring gauges located in zone 1 met the hydrology success criteria of 12.5% for the 2008-growing season. Two of the six monitoring gauges located in zone 2 and 3 met the hydrology success criteria of 8.0% - 12.5%. Gauges MCGW-2, MCGW-3, MCGW-4, MCGW-5, MCGW-6, MCGW-11, MCGW-12 and MCGW-13 did not meet the required successful hydrology criteria. All three surface water gauges demonstrated periods of inundation throughout the growing season.

NCDOT proposes to discontinue hydrology monitoring at the Marks Creek Mitigation Site.

Marks Creek
30-70 Percentile Graph
Raleigh, NC



3.0 VEGETATION: MARKS CREEK MITIGATION SITE (YEAR 5 MONITORING)

3.1 Success Criteria

The success criteria state that there must be a minimum of 320 trees per acre living for at least three consecutive years. A minimum of 290 trees per acre must be living at year 4, and a minimum of 260 trees per acre must be living at year 5.

3.2 Description of Species

The following tree species were planted in the Wetland Restoration Area:

Taxodium distichum, Baldcypress

Fraxinus pennsylvanica, Green Ash

Nyssa aquatica, Water Tupelo

Quercus falcata var. *pagodaefolia*, Cherrybark Oak

Liriodendron tulipifera, Yellow Poplar

Quercus michauxii, Swamp Chestnut Oak

Platanus occidentalis, Sycamore

The following tree species were planted in the Wetland Enhancement Area:

Fraxinus pennsylvanica, Green Ash

Quercus lyrata, Overcup Oak

Nyssa sylvatica var. *biflora*, Swamp Blackgum

Taxodium distichum, Baldcypress

The following tree species were planted in the Upland Area:

Quercus falcata var. *pagodaefolia*, Cherrybark Oak

Quercus nigra, Water Oak

Quercus phellos, Willow Oak

Quercus falcata var. *falcata*, Southern Red Oak

3.3 Results of Vegetation Monitoring

Table 2. Vegetation Monitoring Statistics

Plot #	Overcup Oak	Swamp Blackgum	Baldcypress	Green Ash	Water Tupelo	Cherrybark Oak	Yellow Poplar	Swamp Chestnut Oak	Sycamore	Total (5 Year)	Total (at planting)	Density (Tree/Acre)
1 (Enhancement)	2		18	9						29	39	506
2			19	4	6	1	3	3	2	38	38	680
3			4	5		13	14	5	7	48	48	680
4			10	4	4	2	3	7	5	35	43	553
	Average Tree Density											**605**

* Plot 1 is located in the Wetland Enhancement area.

Site Notes: Other species noted: **Enhancement Area:** *Scripus* sp., red maple, *Juncus* sp., *Sagittaria* sp., cattail, cut grass, and various grasses. There is still some beaver activity occurring on site. Some of the baldcypress and green ash had re-sprouted from the stumps left by the beavers. **Restoration Area:** red maple, sweetgum, goldenrod, sedge, tear-thumb, lespedeza, woolgrass, *Baccharis* sp., black willow, *Scripus* sp., fennel, *Juncus* sp., *Pluchea* sp., pine, smartweed, silky dogwood, alder, cattail, and various grasses.

3.4 Conclusions

Approximately 13.49 acres of this site were planted in the wetland enhancement area and 6 acres of this site were planted in the upland area in March 2002. Approximately 12.66 acres of this site were planted in the wetland restoration area in April 2003. The wetland restoration area was supplementally planted in March 2004 due to low survival of trees observed the previous year. There were 4 vegetation monitoring plots established throughout the wetland enhancement and restoration areas. The 2008 vegetation monitoring revealed an average density of 605 trees per acre, which is well above the minimum success criteria of 260 trees per acre.

NCDOT proposes to discontinue vegetation monitoring at the Marks Creek Mitigation Site.

-4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

For the fifth year of monitoring, three of the seven monitoring gauges located in zone 1 met the hydrology success criteria of 12.5% for the 2008-growing season. Two of the six monitoring gauges located in zones 2 and 3 met the hydrology success criteria of 8% - 12.5%. Gauges MCGW-2, MCGW-3, MCGW-4, MCGW-5, MCGW-6, MCGW-11, MCGW-12 and MCGW-13 did not meet the required successful hydrology criteria. All three surface water gauges demonstrated periods of inundation throughout the growing season.

There were four vegetation-monitoring plots established throughout the wetland enhancement and restoration areas. Based on the results of the fifth year of monitoring, the site revealed an average density of 605 trees per acre, which is well above the minimum success criteria of 260 trees per acre.

An on-site agency meeting was held in August 2005 to review the location of the new gauge (MCGW-13), which was installed in July 2005. It was observed that a small portion of Zone 1, located just south between GW-7 and GW-8, is situated on a knoll. All of Zone 1 has currently been debited, therefore if this area needs to be addressed in the future, available credits from zones 2 and 3 should be considered as compensation.

An on-site agency meeting was held in April 2006 to review the stability of the stream restoration. Six days prior to the onsite meeting, a severe storm occurred damaging a transformer at a Progress Energy Substation upstream of the mitigation site. Approx. 16,000 gallons of mineral oil was spilled into the UT to Marks Creek. Cleanup activities occurred for several weeks after the spill and at this time the site continues to recover with much of the affected vegetation returning.

NCDOT proposes to discontinue hydrologic and vegetation monitoring at the Marks Creek Mitigation Site.

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOS & PLANTING PLAN

Marks Creek

Photo Point #1 (South)

Photo Point #2 (East)

Photo Point #3 (East)

Photo Point #4 (West)

Photo Point #4 (Northeast)

Photo Point #5 (North)

July 2008

Marks Creek

RESTORATION AREA

Photo 1

Photo 2

Photo 3

Photo 4

July 2008

Marks Creek

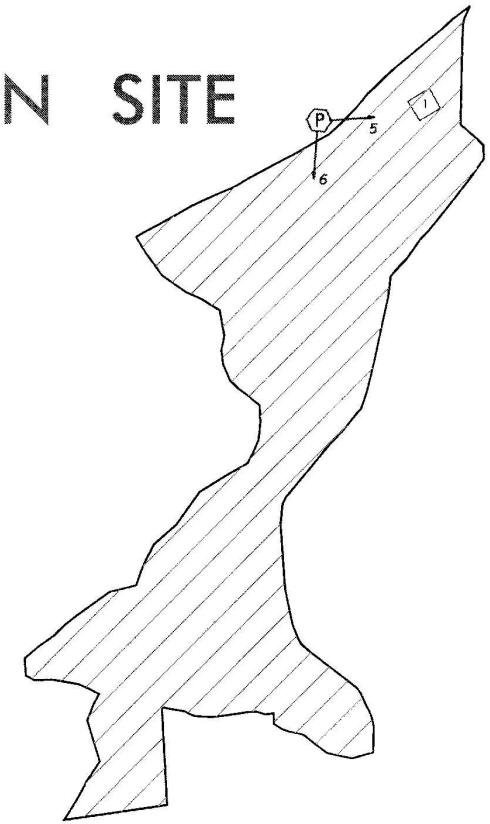
Enhancement Area

Photo 5

Photo 6

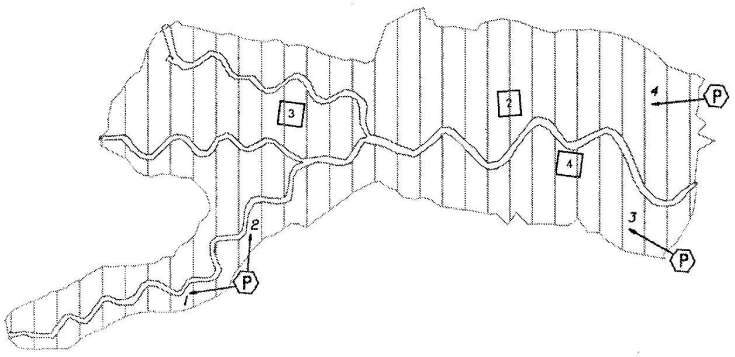
July 2008

MARKS CREEK MITIGATION SITE



Enhancement Area

Restoration Area



PLOT LOCATIONS

P PHOTO LOCATIONS

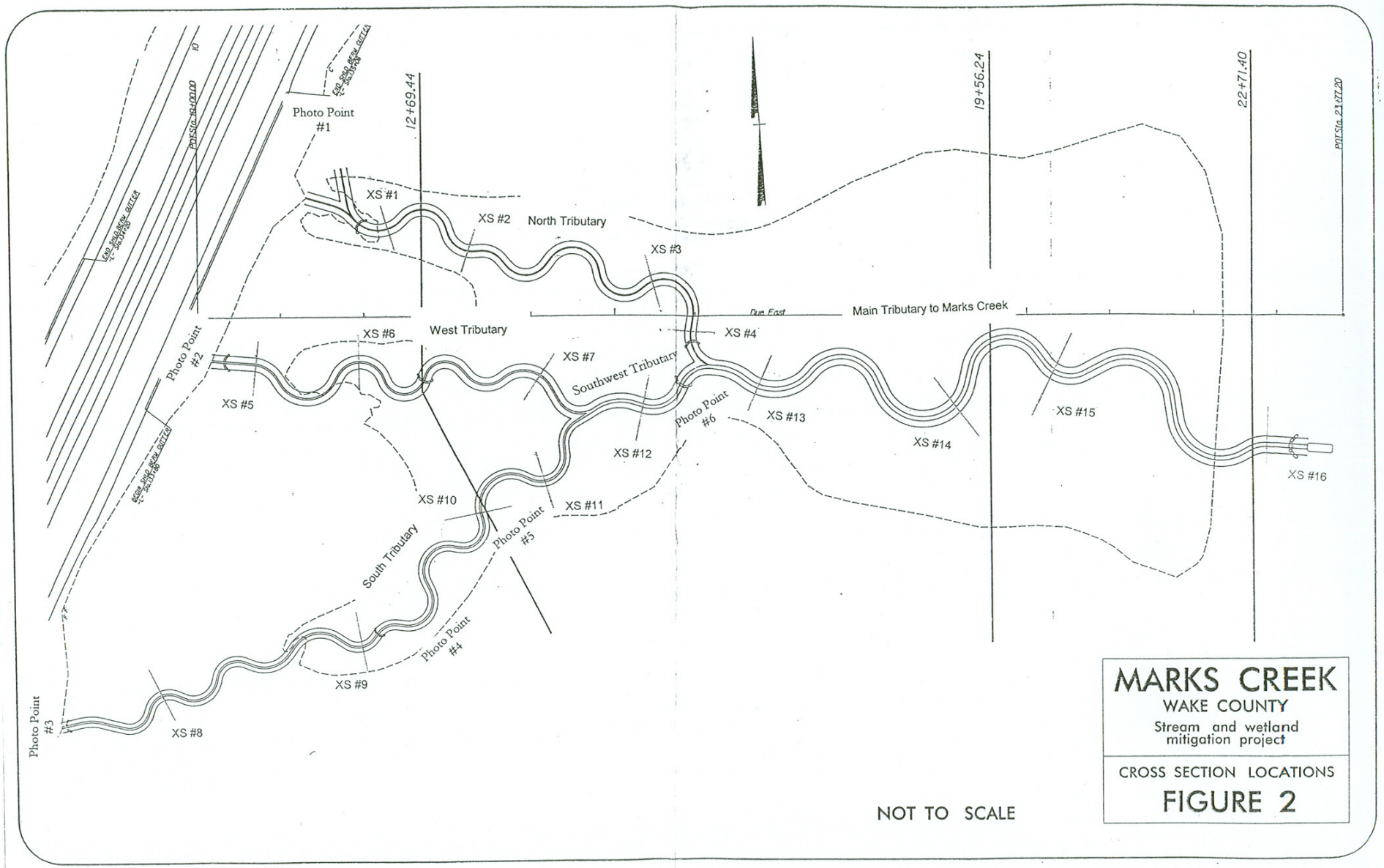


Photo Point #1
12+69.44
19+56.24
22+71.40
XS #1
XS #2
North Tributary
XS #3
Main Tributary to Marks Creek
West Tributary
XS #4
XS #5
XS #6
XS #7
Southwest Tributary
Photo Point #2
Photo Point #6
XS #12
XS #13
XS #14
XS #15
XS #16
XS #10
XS #11
South Tributary
Photo Point #5
Photo Point #4
XS #9
XS #8
Photo Point #3
NOT TO SCALE
MARKS CREEK
WAKE COUNTY
Stream and wetland mitigation project
CROSS SECTION LOCATIONS
FIGURE 2